

This listing of claims will replace all prior versions, and listings, of claims in the application.

**Listing of Claims:**

1. (Currently Amended) A PET detector comprising:  
a Lanthanum Halide scintillator comprising a plurality of Lanthanum Halide crystals, said scintillator having a decay time constant  $\tau \leq 35$  ns and a light output at least equal to the light output of NaI(Tl);  
a light guide; and  
a plurality of photomultiplier tubes,  
wherein said Lanthanum Halide scintillator crystals, said light guide and said photomultiplier tubes are arranged respectively peripherally around a cavity for accepting a patient.
2. (Currently Amended) A PET scanner comprising:  
a cavity for accepting a patient; and  
a plurality of PET detector modules arranged in an approximately cylindrical configuration about said cavity, each PET detector including a Lanthanum Halide scintillator comprising a plurality of Lanthanum Halide crystals and said scintillator having a decay time constant  $\tau \leq 35$  ns and a light output at least equal to the light output of NaI(Tl), a light guide, and a plurality of photomultiplier tubes, wherein said Lanthanum Halide scintillator crystals, said light guide and said photomultiplier tubes are arranged respectively peripherally around said cavity.
3. (Currently Amended) A PET scanning system comprising:  
a PET scanner comprising a cavity for accepting a patient and a plurality of PET detector modules arranged in an approximately cylindrical configuration about said cavity, each PET detector including a Lanthanum Halide scintillator comprising a plurality of Lanthanum Halide crystals and said scintillator having a decay time constant  $\tau \leq 35$  ns and a light output at least equal to the light output of NaI(Tl), a light guide, and a plurality of photomultiplier tubes, wherein said Lanthanum Halide scintillator crystals, said light guide and said photomultiplier tubes are arranged respectively peripherally around said cavity;

a time stamp circuit that records the time of receipt of gamma rays by respective PET detectors and provides timing data outputs; and

a processor that receives said timing data outputs, calculates time-of-flight (TOF) of gamma rays through a patient in the cavity, and uses said TOF of gamma rays in the reconstruction of images of the patient.

4. (New) A PET detector as in claim 1, wherein said scintillator comprises  $\text{LaBr}_3$ .
5. (New) A PET detector as in claim 1, wherein said scintillator comprises  $\text{LaCl}_3$ .
6. (New) A PET detector as in claim 1, wherein said scintillator crystals are about 30 mm thick.
7. (New) A PET detector as in claim 1, wherein said scintillator crystals have cross-sections of approximately 4 mm by 4mm.
8. (New) A PET detector as in claim 1, wherein said scintillator crystals are connected to said photomultiplier tubes through a light guide using optical coupling.
9. (New) A PET scanner as in claim 2, wherein said plurality of PET detector modules are arranged in an approximately cylindrical configuration about said cavity.